

ESKER POINT BEACH MAINTENANCE PROGRAM
REVISED FINAL REPORT 7-24-17
Revised 8-8-17

Introduction

Esker Point Beach is a manmade feature in the Town of Groton, CT between Esker Point and the Noble Avenue neighborhood to the east. It was developed in order to provide what seemed to be an obvious, but unfortunately not so simple, realization of a beach facility for waterfront access and recreation. Sand was placed repeatedly and extensive efforts undertaken to create a recreational facility for all of the Town residents to enjoy. Almost immediately, the forces of nature began to indicate that there would be some difficulties with this plan. Some problems were due to inherent characteristics of the site, some to climate, some were attributable to nearby development and some were apparently accidental.

It should be noted that other studies have been undertaken to analyze and address the physical and oceanographic characteristics of this site with some of the same observations and conclusions we find ourselves facing at this time (TPA, 1985). The site characteristics were discussed at considerable length, noting that the beach is generally a coarse sandy beach, thus contributing to its stability to some extent. The coarseness of the upper beach sand appears to be at least partly the result of wind driven winnowing of the sandy deposit favoring removal of the finer grained fraction of the deposited sands but is also attributable to raking where fine-grained sand from the substrate is brought to the surface where, subsequently the fine-grained material erodes to the intertidal and subtidal zones by rain splash, wave back wash and physical disturbances such as human activities and wind. Anticipating sand excavation from the beach along the Noble Avenue properties and replacement of that sand on the beach, and DEEP Natural Diversity Data Base (NDDDB) Determination of impact was requested and will be included as an attachment to this report.

The current geologic profile on the Esker Point Beach is shallow sand cover over rock. The natural predevelopment features of the beach were rock. It appears that a sandy strip formed across the rocky beach at the top of the intertidal zone in the 1934 photograph. The “manmade” impacts on the site were to add to existing sand repeatedly but the rocks still lie just beneath the sandy surface for the entire beach feature at this site. The existing inter-tidal area is predominantly fine-grained material. Out 1,000 feet or so offshore is generally a low energy depositional regime where the bottom sediments are primarily fine-grained sands tending towards silts. The offshore bottom sediments are reasonably well consolidated, indicating long term deposition of fine sands into the area that decades ago, had a softer, muckier bottom supporting some amount of eel grass, which has not been observed at the site in 20 years. Discussion of the climatic, tidal and geophysical characteristics of the site has been prepared for this assessment and has been incorporated into this project summary report, followed by the concerns of various study participants who live next to and use the park and those who maintain the property as well.

GEOPHYSICAL AND OCEANOGRAPHIC CONSIDERATIONS

Esker Point Beach is located along the southern limits of Fort Hill in an area that historically was dominated by a series of drainage channels or streams bordered by wetlands and tidal marsh interrupted by outcrops of bedrock, boulders and glacial till. Waters moving downhill drained into

a shallow embayment bounded to the west by Esker Point and to the east by Morgan Point and West Cove. Aerial photographs prior to the 1970's show a narrow east-west trending sand beach in this area extending from the western edge of West Cove, fronting what is now Noble Avenue, to the terminus of Esker Point (Fig. 1). Offshore sediments appeared to consist primarily of finer grained silts and clays with the alongshore sands derived from wave induced sorting or winnowing of materials eroded on the shore and/or from upland glacial deposits and transported seaward by streamflows. The absence of bluffs or prominent erosion features in the area in combination with small streamflow volumes suggests that the mass of sediment provided by either source is limited. The overall area is "sediment poor" with organic materials representing a significant fraction of mobile sediment.

Over the year's road and rail construction have segmented the natural drainage pathways from Fort Hill requiring placement of concrete, metal and composition drain lines routed to various locations along the shore. In 1967, the sediment regime in the area was significantly modified by the placement of a large volume of sands by the Town of Groton to form a recreational beach having an area of approximately 6 acres with a maximum width of approximately 250 ft extending east-west from the Noble Avenue residences to the terminus of Esker Point (Fig.2). The complex was initially intended to support the full range of recreation activities including picnicking, swimming, sunbathing and assorted games (horseshoes, volleyball etc.). Difficulties in the management of seaweed deposits in the nearshore area, in combination with soft bottom texture and shallow depth, confined primary beach use to the onshore. Subsequent planning efforts in the early 1980s recognized these factors and directed efforts to the development of a "family oriented waterfront park without swimming privileges" (TPA, 1985). Essential to the success of this concept was the long-term stability of the placed sand beach.

The stability of the placed sand deposit forming Esker Point Beach is a function of a variety of factors including the grain size distribution of the placed sands, beach contours, winds and wind waves, tides and tidal currents, and both surface and sub-surface groundwater flows. Surficial samples obtained at several locations along the beach above the intertidal area indicate that present day sands consist of materials ranging from fine gravel and small pebbles to silts (Fig.3). The median grain size is approximately 0.7mm or fine sands. In composition, the placed sands are primarily yellowish-brown aluminosilicates with low angularity and appear to have been obtained from upland glacial outwash deposits. Analysis of samples west to east along the upper beach through the area of the volleyball courts (Fig.2) indicates little change in grain size distributions with only minor reductions in the coarser fractions in the area of the courts resulting from periodic roto-tiller grading and raking to maintain the playing surface. Moving into the intertidal there is a substantial change in size distributions resulting from wind wave induced winnowing and sorting. Surface sediments in this area are well sorted and more nearly uni-modal than the upper beach sands with negligible amounts of material coarser than 2mm (Fig.4). Median grain size has decreased to 0.4mm and the majority of fines have been removed.

Present contours of the placed sand deposit proceed from an elevation of approximately 8ft above mean sea level at the base of the slope down from the adjoining Groton Long Point Road which is at an elevation of approximately 10 feet and gently decrease to an elevation of approximately 5 ft

over a distance of approximately 100 to 120ft. Beyond this point beach slope increases through the intertidal zone to 5-7% down to mean sea level. Continuing seaward, the beach slopes decrease rapidly. Within 50 ft, bottom contours become nearly horizontal with depths remaining less than 4-ft below mean sea level over a distance of more than 400-ft from shore.

In common with much of Long Island Sound the wind field affecting Esker Point Beach is dominated by southwesterly winds during the summer and north westerlies during the winter. Aperiodic high energy events rich in southerly and easterly components can occur at any time during the year but are most common during the fall and spring transition periods. The east-west orientation and adjoining landmass sheltering makes the beach susceptible to winds from the northwest and south through southeast. The associated Aeolian transport favors removal and transport of the finer fraction of the placed deposit resulting in a coarsening of the surficial sediments along the upper beach and deposits of finer materials along the backshore of the beach and adjoining roadway in southerlies or the intertidal area during northerlies.

In addition to direct wind driven transport of sands, prevailing winds can also generate surface waves sufficient to resuspend and transport sands in the intertidal region. For the region of Esker Point Beach this factor is considered to represent the major component of the offshore transport regime affecting both rates and routes of sand transport and the resulting composition of materials deposited in the course of this transport. Beach location and orientation result in the dominance of waves from the south. Adjoining headlands and local water depths cause a combination of refraction and diffraction sufficient to bring waves propagating in the open Sound from the east, south and west into the Esker Point embayment with little decrease in energy. As these re-directed waves, now proceeding from the south, approach the shore the shallow depths of the embayment favor shoaling and some breaking reducing energies prior to impact along the intertidal. As a result of this dissipation incident waves in this area typically have periods less than 1-2 sec and amplitudes less than 1.5 ft. These wave characteristics and associated energy levels and transport can be significantly affected by tidal conditions.

Water level elevations along Esker Point Beach are dominated by the semi diurnal astronomical tide. This periodic rise and fall serves to displace waters producing flows in the adjoining embayment having typically low velocities insufficient to directly erode beach sands. These flows can however, affect transport of materials suspended by the incident wave field. The effect of the tide on incoming waves is principally a function of tidal range. The average tidal range in this area is approximately 2.5 ft. Analyses of historical tidal data indicate that aperiodic storms can significantly affect this range. Storms with an expected recurrence interval of one year can result in still water elevations approaching 4 ft above mean sea level. Such an elevation would result in waves impacting the entire steep face (the area of 5-7% slope) of the beach across and beyond the intertidal. A storm with a ten-year probable frequency of occurrence would increase elevation to 6.5 ft above MSL affecting more than half of the width of the beach. Associated with this increase in elevation would be a reduction in wave shoaling in the offshore due to the increase in water depth favoring less dissipation and higher energy waves along the immediate shoreline. Such conditions were observed in the area during the passage of Storm Sandy in 2012. It's likely that

such extreme events modulated by tidal conditions dominate the shore parallel transport of sediment affecting Esker Point Beach.

Drainage of surface and subsurface waters represent the final factor affecting the displacement of sands along Esker Point Beach. It is often forgotten that extreme storms often represent a combination of both high winds and abundant rainfall. This latter factor acting together with winds and wind waves can directly and indirectly affect the erodibility and transport of beach sands. Surface runoff of rainfall can produce localized flows sufficient to directly erode and transport sands producing narrow gulley's across the beach face down to the intertidal. Alternatively, precipitation may migrate down through the less consolidated surface sands until reaching a less permeable level. The resulting down gradient flow along that surface ultimately "breaks out" in the intertidal region. The interaction between these groundwater flows and wave induced flows, particularly the backwash following wave breaking, results in velocities sufficient to increase sediment erosion beyond that resulting simply from wave impact. Gulley's that appear representative of such drainage associated erosion are regularly seen along Esker Point Beach (Fig.5). The exact cause of these gullies, be they surface runoff features or the result of a subsurface "breakout", cannot be simply defined and requires additional study. In any case, it is clear that drainage does result in some beach erosion with amounts a function of the intensity of the rainfall event.

Acting individually and in concert the above factors act to reshape the placed sands on Esker Point Beach in order to produce contours that provide reasonable long-term stability. Under normal circumstances this stability would be achieved when there was a neat balance between transport energies and sediment supplies. Since the natural sediment supply (recharge) is limited to non-existent at Esker Point, the best that can be hoped for is a configuration that provides minimum erosion rates.

In this system erosion rates were highest immediately following initial placement in 1967 and progressively decreased as materials were redistributed by winds, waves and tidal currents. Initially the most evident result of this process was the transport of fine sand from the placed deposit to the east forming an evident intertidal bar in front of the Noble Avenue residences (Fig.6) which significantly reduced water depths in the adjoining intertidal area (Fig.7). Some amount of this material continued moving to the east and then southeast across the entrance to West Cove and further offshore. Comparison of topographic and bathymetric survey data taken in 1984 and 2014 (Fig.8) shows a significant change in offshore contours over the period with depths decreasing by 0.5 to 1 ft throughout the area extending to 200 ft south of the Esker Point Beach.

Closer to shore, to the east, water depths have decreased by more than 2 ft at many locations. Analyses of surficial grab samples obtained at a number of stations in the area (Fig. 8 inset) in 2016 indicate a dominance of sandy silts (Fig.9) at all stations forming a hard, consolidated, bottom contrasting sharply with the high-water content, organic rich bottom found in the area prior to 1967. Beyond this compositional change observations also indicate that there has been a substantial change in vegetative cover in the area.

Earlier studies had indicated a dominance of eelgrass (*Zostera marina*) and sea lettuce (*Ulva lactuca*) among others (TPA, 1985). During the 2016 survey there was no sign of these plants with observed near bottom algae dominated by a red seaweed (*Heterosiphonia japonica*) which formed abundant deposits along the intertidal. The survey data, in combination with the fact that the Town has had to periodically re-nourish Esker Point Beach to maintain desired contours are representative of a system experiencing continuing erosion sufficient to affect a large area offshore. Unfortunately, rates and trends cannot be accurately specified due to limited survey data profiling the beach and offshore and the absence of information regarding the volumes and composition of re-nourishment sands.

NEIGHBOR CONCERNS

The beachfront, originally constructed in 1967, was restored in the late 80s with a sand placement program. In addition, from 1976 to 1992, it is reported that the Town brought in sand to the beach on an as needed basis in preparation for summertime activities. A significant fraction of these re-nourishment sands, particularly the finer grained fraction of the surface materials became dislodged by wind, rain, storm tides, wind waves and erosion assisted by surfacing groundwater. A percentage of these sands moved easterly along the shore and ended up in front of the homes on Noble Avenue and offshore. Other fractions moved further offshore. Ground water levels appear to have risen and it has been reported that some basements are now more regularly subject to flooding.

The primary concerns of the neighbors are the accumulation of sand in front of their properties and the smell attributable to the decomposing subtidal vegetation throughout the area. Neighbors have also experienced an increase in trash accumulating along the shoreline at their homes, apparently stranded due to the shoaling tendency of the cove in the easterly nearshore areas.

Docks that were built in the past 25 years off the Noble Avenue seawall have become inaccessible for boating. In several cases sand has accreted to a point of being almost level with the docks, a gain of approximately 6 feet of sand. Direct boating access from the seawall has been lost at four of these properties.

The neighbors indicated that they would be agreeable to a reduction of sand in front of their properties on the order of 4 feet in general. Recycling of this sand and containment on the high beach would be agreeable by the neighbors but not importing and spreading new sand which would be strongly objected to.

VOLLEYBALL CONCERNS

One of the results of the progressive winnowing of finer grained surficial sand is that the volleyball court sand becomes coarser. The lag, and in particular the coarse sand and pebbles remaining after the windblown removal/winnowing of the finer fractions are not desirable from a volleyball standpoint. More uniformly fine-grained sand would be preferable. Samples were taken of the Esker Point court sand and compared to the New London's Ocean Beach volleyball courts, generally regarded as the best Court in the area. Analyses of the grain size distributions from both sites (attached) provide clear indication that the Ocean Beach sands are more uniformly graded than the Esker Point materials and display a finer mean grain size. Some effort to replicate this

distribution at Esker Point to increase the desirable sand characteristics and the simplify Court maintenance appears warranted.

In addition to the textural considerations the west volleyball courts tend to retain water after a rainfall apparently due to a low permeability layer or the general saturated nature of materials at depth. The volleyball league, in general, anticipate losing a whole day after significant rainfall while these courts drain. From this location, the drainage process appears to be primarily downwards percolation due to the porosity of the sand.

Beyond water retention the courts have a tendency to become somewhat pan or bowl shaped and tend to stay that way during the course of summer activities. This may be the result of simple material displacement by the player's activities. Mere raking of the surface does not resolve this general bowl-shape characteristic; resolution would require regular re-grading.

DRAINAGE CONCERNS

In addition to the variety of natural factors affecting the stability of Esker Point Beach there are clearly a number of drainage issues with the potential to adversely affect long term stability of the placed sand and the form or shape of the beach. The apparent retention of water at several locations on the beach following rainfall may be the result of drainage from the dry well installed at the westerly end of the Noble Avenue development in combination with run-off from Rte. 215. It also appears that a drainage pipe which daylights just west of the Noble Avenue neighborhood is blocked allowing no flow. A sink hole was observed just to the southwest of the Noble Avenue seawalls indicative of a mal-functioning drain line. Each of these situations warrants additional investigation since overland and subsurface drainage has the potential to induce erosion of the beach face both directly and indirectly. In addition, these additional drainage waters may be contributing to the observed basement flooding in residences along Noble Avenue.

CONSIDERATIONS GOING FORWARD

One of the decisions that must be made is whether to document and study the beach further without pursuing site changes or to pursue site changes without further study. Considering the geophysical and oceanographic characteristics of the site previously discussed, the long-term management of Esker Point Beach must recognize the fact that this beach is subject to continuing erosion and direct efforts to reduce erosion rates to a minimum. To the extent possible these efforts should be based on data rather than subjective observation. A recommended approach would start with a detailed topographic/bathymetric survey of the beach and adjacent offshore out to approximately 500 ft and longshore from the Point to the entrance of West Cove. This survey would be repeated annually for five years at an estimated fee of \$5,000 for each survey. In order to be objective, subject only to natural influences, there would be no re-nourishment during this period and a minimum of re-grading. The resulting data could serve to define the areas experiencing erosion and deposition and the associated rates; of course, the surveyed conditions would only reflect a response to whatever climatic influences arise during the study period.

In the active approach, beach management efforts should be directed to control as many of the factors affecting erosion (discussed above) as possible. In particular, the issue of drainage should

be carefully examined. The beach area was historically a watershed drainage outlet and, understandably devoid of sand. Drainage modifications were made at the beach on Rte. 215 and Marsh Road, Noble Avenue were developed but records of what was done are incomplete and system functionality is not known nor is it discernable with certainty based on beach surface conditions.

It is possible that some relatively simple steps such as control of the drainage from the paved apron and pedestrian access way leading from the road to the beach could measurably reduce erosion and the associated transits of the beach. In addition, clearing of what appear to be plugged drainage piping could significantly increase flow and discharge capacity during high intensity rainfall reducing or eliminating overflows. To these should be added some amount of regular inspection to insure ongoing drain integrity.

Every effort should be made to keep raking activities to a minimum, eliminate vehicular traffic along the beach, and to initiate a program to reduce Aeolian transport. Large vehicle traffic or aggressive raking along the beach creates furrows and disaggregates surface sediments. These factors increase erodibility associated with both winds and rainfall runoff. The more general matter of Aeolian transport can be addressed in several ways. Given the sensitivity of the beach to winds, particularly during the winter, transport can be reduced by the seasonal placement of snow fencing with one course running along the upper intertidal or the southern limit of the volleyball courts and a second course along the back of the beach below the adjoining roadway. This effort might begin with a single course of fence placed along the upper intertidal during the first year to allow evaluation of the need for and optimum location of a second course.

Consideration should be given to an extension of the beach grass plot that has developed naturally along the southeastern limits of the beach. The health of this plot indicates that it is now trapping and benefiting from sands being blown across the beach. Extension of this plot to the southwest will increase trapping of sands blown by northwest winds and at least in part decrease the transport of materials to the residential properties to the east of the beach and help with establishment and maintenance of dune like features which should tend to retain sand. This work could be the most cost efficient and environmentally beneficial option available.

Beyond the control of erosion, effort should be directed to improvements in the volleyball courts to reduce the pebble fraction and the tendency to retain water following rainfall. Sand characteristics that prove undesirable to all users (high pebble fraction) appear to be simply a function of sand grain size distributions. As noted, the preferred sand gradation at Ocean Beach has only a minor coarse-grained fraction with essentially no pebble sized materials. A similar distribution is very nearly displayed by the materials residing along the intertidal extending along the shorefront of the adjoining Noble Avenue residences (see attached Figures 6 and 7. Windblown winnowing and subsequent wave and tidal current transport have effectively eliminated the coarser fractions from the sand in front of the Noble Avenue houses. The possibility of using these fine-grained materials in the reconstruction of the portion of the upper beach used as volleyball courts warrants careful evaluation. In particular, the organic content of the materials needs evaluation. It is likely due to the observed coloration of these materials that when first

excavated they may emit odors as the organics oxidize. This should be manageable and acceptable if these sands prove to be desirable court material and at the same time by excavation allow some amount of restoration of the historic shoreline contours along the adjoining Noble Avenue residences to pre-1967 conditions.

The matter of water retention by the volleyball courts requires evaluation of the subsurface structure of the sediments focusing on permeability as well as careful evaluation of the drainage systems with the potential to affect the court area. The structure of the sediment column can be evaluated during the excavation that will be needed to allow replacement of the existing materials by the preferred finer grained more nearly uni-modal sands. If the issue is rock or ledge, little can be done. If, however, examination reveals low permeability silt/clay dominated materials, these can be replaced prior to back filling.

If water retention is really a matter of continuing flow entering the area due to backshore drainage following rainfall the drainage runoff routes and patterns from Rte. 215, the parking lot, and the Marsh Road phragmites growth area should be investigated to see what, if any, drainage improvements can be made. Particular effort should be made to eliminate surface, focused swale, and piped runoff in the vault area across the site. In addition, consideration should be given to the installation of an underdrain system sloping down from the beach building east to the dry well or vault. The dry well overflow pipe should be cleaned out and the dry well perforations plugged to force the accumulated drainage waters to flow out into the cove. This may require replacement of the pipe with a bulkheaded armored swale or sluiceway and would separate the Esker Point beach from the Noble Avenue neighborhood. Allowing rainfall run-off and high ground water to drain freely could help lower the hydraulic profile between Marsh Road and the shoreline. Necessarily any blockage at the discharge end of the system would tend to continually recharge the ground water in the volleyball area, a factor that would be made evident by standing water in the court area after rainfall. Regular maintenance is required to prevent this. A side benefit of the improved drainage related flows to the offshore might be a decrease in the amount of stranded seaweeds as the flow carries some fractions south and offshore.

The selective infilling of the volleyball court area with finer, near uni-modal material will require some additional maintenance beyond that presently conducted. Initial placement should result in a slightly convex or domed profile – higher in the middle than at the edges. With use this profile will degrade as materials are displaced laterally during play. This lateral transport may result in some amount of material being carried outside the court area spreading over the coarser upper beach sand. To prevent this, the area receiving the fine-grained sand should extend well beyond the court area. In addition, care must be exercised during the reconstruction of the domed profile to prevent an intrusion of the coarser material from the border areas. To this end it would be beneficial to use mat raking on the upper beach and volleyball courts daily, weekly and after storms. Raking from low to high grounds on the beach would be preferable to keep the fine-grained sand on the high beach and away from the erosion loss susceptibility zone. Foreshore to back shore directional mat raking, even on a daily basis, will not be detrimental to beach sand preservation. York raking, on the other hand, will tend to continually cause pebbles to resurface and should not be used on the volleyball courts or the high beach as it will tend to promote sand loss.

In addition to physical disruptions during the season, the finer grained sands on the volleyball courts will be more susceptible to windblown transport. Depending on the results of the studies of

the effectiveness of snow fencing in reducing or eliminating this wind erosion loss, it may be necessary to stockpile court materials along the upper beach during the off-season. If stockpiling proves necessary, every effort should be made to prevent mixing with the coarser upper beach sands and/or windblown transport. Consideration should be given to tarp covering stock piles or berms if snow fencing proves to be insufficient.

PROACTIVE BEACH MANAGEMENT OPTIONS

Several considerations and alternatives have been raised during various meetings and discussions, some of which could be implemented at this time, others after permits are obtained and some which could be explored in greater detail. Sketches are attached to add some clarity to various alternatives. Opinions of costs are offered based on discussions with various contractors who have provided similar services on similar projects elsewhere. Work which can be all completed by the Town would probably be considerably less expensive than hiring a contractor.

- Conduct annual sand preservation mounding or berming to keep the fine-grained sand on the high beach out of the reach of wave induced erosion characteristics of the site as much as possible.
- Regrade the coarse shoreline sands at the upper intertidal zone (HTL) to be slightly more abrupt to diminish wave travel up the beach and loss of high beach sand. Keep the coarser sand in the intertidal zone and the fine sand up on the high beach for recreational activities.
- Sand in the volleyball area and upper beach could be screened (onsite or offsite by the Town or by a contractor) and particles larger than the 40 sieve could be swapped out for equal volumes of material from the upper intertidal zone (the high water zone) thus keeping the finer grained material on the upper beach and the coarser less erodible materials in the wave exposure area. Excavation limits should be on the order of a couple of feet. This could be done on selective courts or an area on the high beach as a test.
- Install wind erosion protection such as snow fence annually to reduce windblown sand loss and to increase the retention of fine grain material on the upper beach. Snow fencing is generally about 36 inches high and the accumulation of sand is easily measured from the top down. Snow fencing should be installed at least 40 feet south of the road or northerly vegetation limits and 40 feet north of the foreshore berm and beach grass. These locations are estimates. The optimum location of the fencing may have to be determined in the field by measurement and visual observation. The point will be to be far enough away from vegetation on the north line and not too close to the steep section of the beach where waves will continue to erode the material.
- Remove, manually or by machine marine vegetation which regularly washes into the cove and ends up in the shallow subtidal and intertidal zone at Esker Point Beach.
- Re-grade the volleyball courts to somewhat of a dome shape, and stop “deep raking” the beach with machinery. Raking should be with mats and be directed up gradient.

- Extend the beach grass area in the general pattern depicted on the plans to help encircle the volleyball area for preservation of fine grain sanding material year-round. The sand subject to wind erosion will also tend to accumulate in the beach grass area (similar to the snow fence accumulations). Plants can be purchased (.50 apiece) or transplanted.
- Dredge along the Noble Avenue property seawalls to reclaim fine-grained material which has eroded and been transported to those sites from the beach and keep it “in the system” as a beneficial reuse to maintain the beach. This has been done in the past, however, no evidence has been found to show that this work was authorized by DEEP and ACOE so permitting may not be achievable.
- Cut off Rte. 215 gutter flow with a low-profile ADA compliant berm of 6 inches height (curb height)

Conditions which are beyond the scope of this project could be studied in greater detail:

- Install an underdrain system sloping down from the beach building east to the dry well and clean out/restore the dry well overflow drain pipe. Plug the dry well drainage points to force the accumulated drainage waters to flow out into the cove. This may require replacement of the pipe with a bulkheaded armored swale or sluiceway and would separate the Esker Point beach from the Noble Avenue neighborhood. Allowing rainfall run-off high ground water to drain freely could help to lower the ground water level between Marsh Road and the shoreline, however, blockage at the discharge end of the system would tend to continually recharge the ground water in the volleyball area.
- Investigate drainage runoff from Rte. 215, the parking lot, the Marsh Road phragmites growth area to see what, if any, drainage improvements can be made to eliminate surface and piped runoff across the site and possibly reestablish some generally southeasterly flow and discharge characteristics in the Cove, which might help to remove some decaying or floating vegetation.
- It would seem that some establishment of southerly flow of water in the Esker Point embayment, might help to carry out some of the waterborne decaying vegetation. This would be intended to reestablish the natural course of drainage from predeveloped beach conditions where the Marsh Road marsh drained out through the site.
- In one meeting, a suggestion was offered that installation of a new groin be considered along the east edge of the property or something similar to a Living Shoreline, perhaps a bulkhead backfilled with sand and planted with beach grass, woody stem bushes or trees in a “mangrove” out into the Bay to help retain sand at the beach site. The amount of study that would be required, the permitting issues and the cost of such a structure made pursuit of this option burdensome and unlikely to be successful.

PERMITTING

Several aspects of work referenced above will require permitting to some extent as envisioned below:

- Removing sand from the intertidal zone in front of Noble Avenue properties would require DEEP/ACOE permitting and not be permittable. There would be limits in terms of area and depth of excavation and it is logical to presume that such limits will be stipulated. Permitting would likely have a fee of \$20,000 (including the permit application preparation, wave study, application fee, etc.) using existing survey information and sand grain size documentation has already been done for this study and barring unforeseen project support studies.
- The Noank Fire District Zoning Official has been contacted and indicated that a Coastal Site Plan would be required for regrading the beach and planting new vegetation. The annual “snow fence” installation process would not necessarily require a permit but should be documented in the regrading permitting process. The permitting fee through the Noank Fire District Zoning Commission would be on the order of \$10,000 with \$1,000 being for public notice and application fees and using existing Town surveys and grain size cataloging already done for this study. It was not clear if recapturing sand from the Noble Avenue intertidal area and replacing it on the beach would warrant a special permit or if the work could be covered under the Coastal Site Plan but if so the permitting costs could be double.
- Constructing a gutter flow berm on Rte. 215 will probably require a DOT encroachment permit or modification through the Region 2 office in Norwich.

COSTS

Although it is difficult to anticipate all of the factors which might influence cost of some of the beach modifications discussed. Costs of the work proposed above, anticipating retaining private contractors for such purposes, would be estimated to be as follows:

Screening (offsite) 1,000 CY of sand, re-spreading coarser material in the upper intertidal zone and spreading finer grained materials on the upper beach, \$75,000, per effort.

Excavating 1,000 CY of fine sand and ingrained vegetative matter from the upper intertidal zone area of the Noble Avenue properties, stockpiling that material on the upper beach and trucking the sand laden detritus offsite: \$40,000

Machine sifting the upper beach sand to a depth of a depth of 2 to 4 inches to remove trash and vegetation detritus and estimating 30,000 SF: \$10,000

Installing 600 LF of perforated under drain from the beach building to the Marsh Road-Noble Avenue drainage vault area: \$40,000.

Excavating and resetting the Marsh Road drainage discharge piping from the vault to the daylight end (approximately 200 LF): \$25,000.

Annually installing and subsequently removing 1,000 LF of snow fencing: \$5,000/yr

Annual Topographic Survey of the beach and Hydrographic Survey of the shallow subtidal waters out to 500 feet: \$5,000

Excavating and resetting the Marsh Road drainage discharge piping from the vault to the daylight end (approximately 200 LF): \$25,000

Note: The upper beach area to be addressed in sand sifting, screening and excavating removing decomposing vegetation is roughly 300 feet by 100 feet.

References: TPA Services, 1985 Master Plan of Development. Esker Point Beach, Groton, Connecticut. Prepared for the Town of Groton Parks and Recreation Commission.
TPA Services, New Haven, CT. 11 pps + Figs, Tables and App., copy attached.

Esker Point Recreational Area
1934 Aerial Photograph

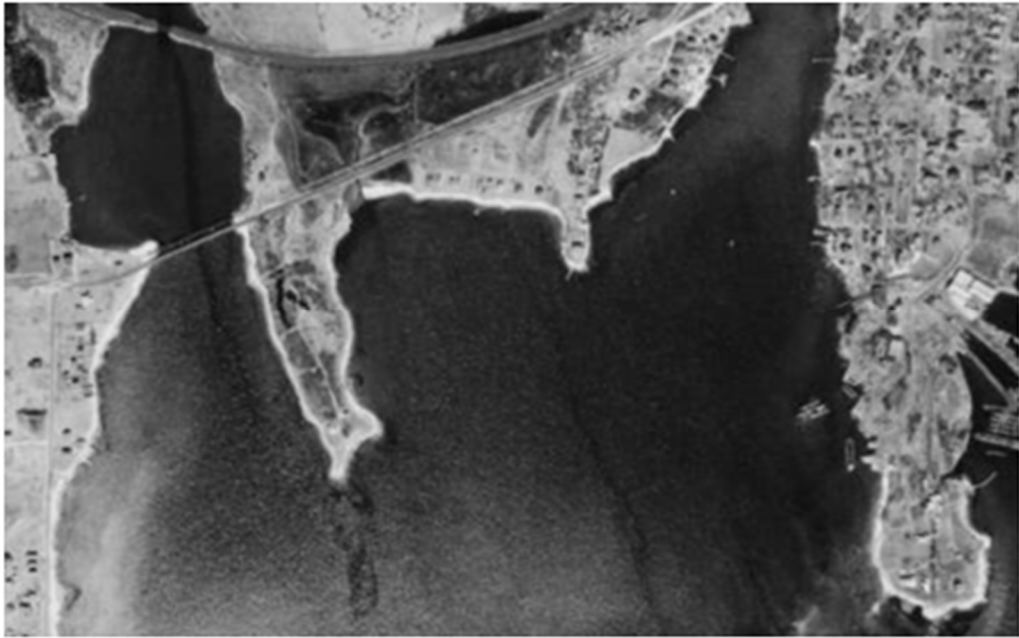


Figure 1 Embayment Adjoining Esker Point - 1934



Figure 2 Esker Point Beach and Adjoining Areas 2016

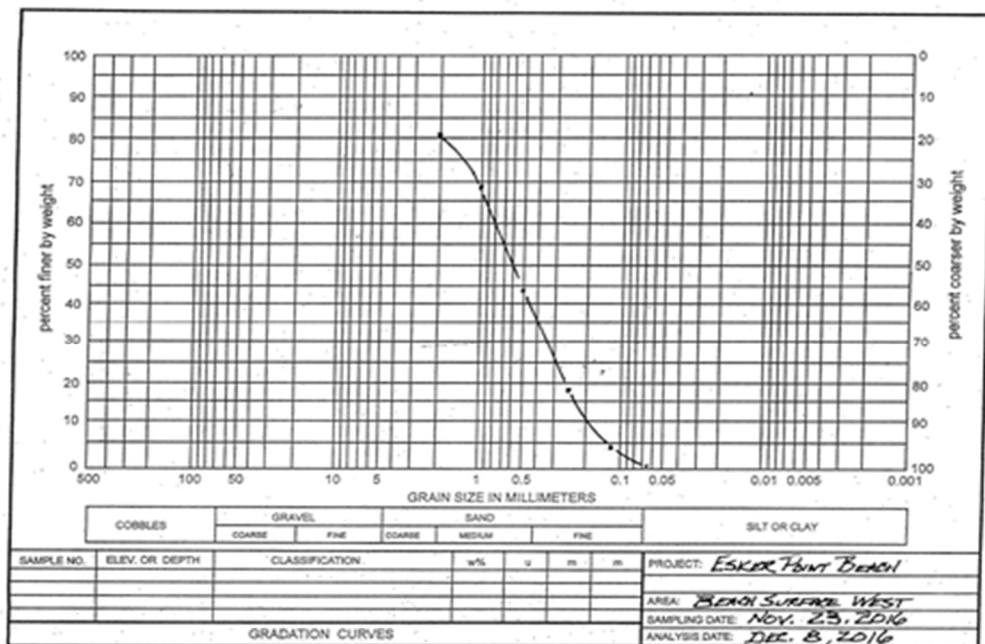


Figure 3 Sediment Grain Size Analysis - Esker Point Beach Surface 2016

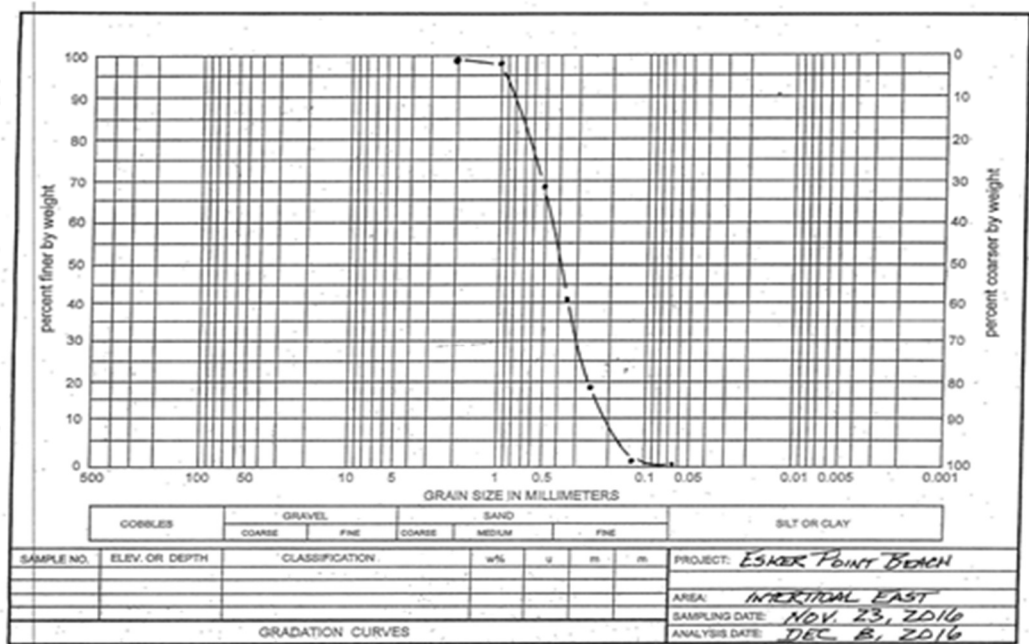


Figure 4 Sediment Grain Size Analysis - Esker Point Beach Intertidal East 2016



Figure 5 Erosion Gulleys on Esker Point Beach January 5, 2017



Figure 6 Aerial View of Esker Point Beach 2015 GIS Map



Figure 7 Low Tide Conditions Looking Southeast from Noble Avenue Residence 2012

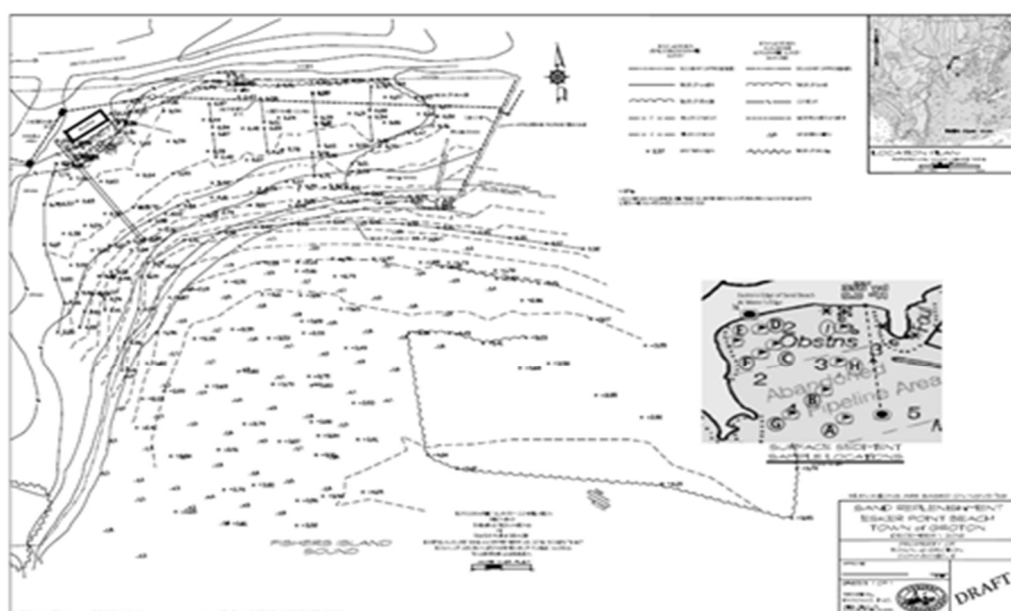


Figure 8 Esker Point Beach – Groton, Connecticut
Comparative Topography and Bathymetry 1984 and 2014
Inset Shows Offshore Sediment Sampling Stations December, 2016

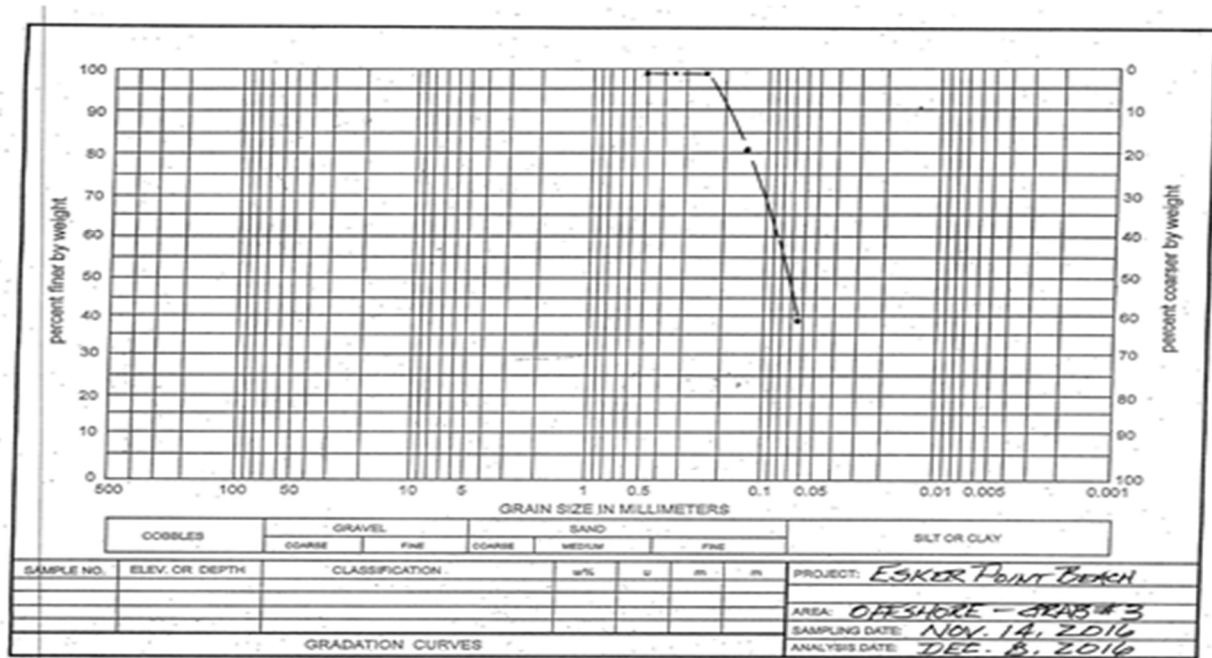


Figure 9 Sediment Grain Size Analysis - Esker Point Beach Offshore 2016

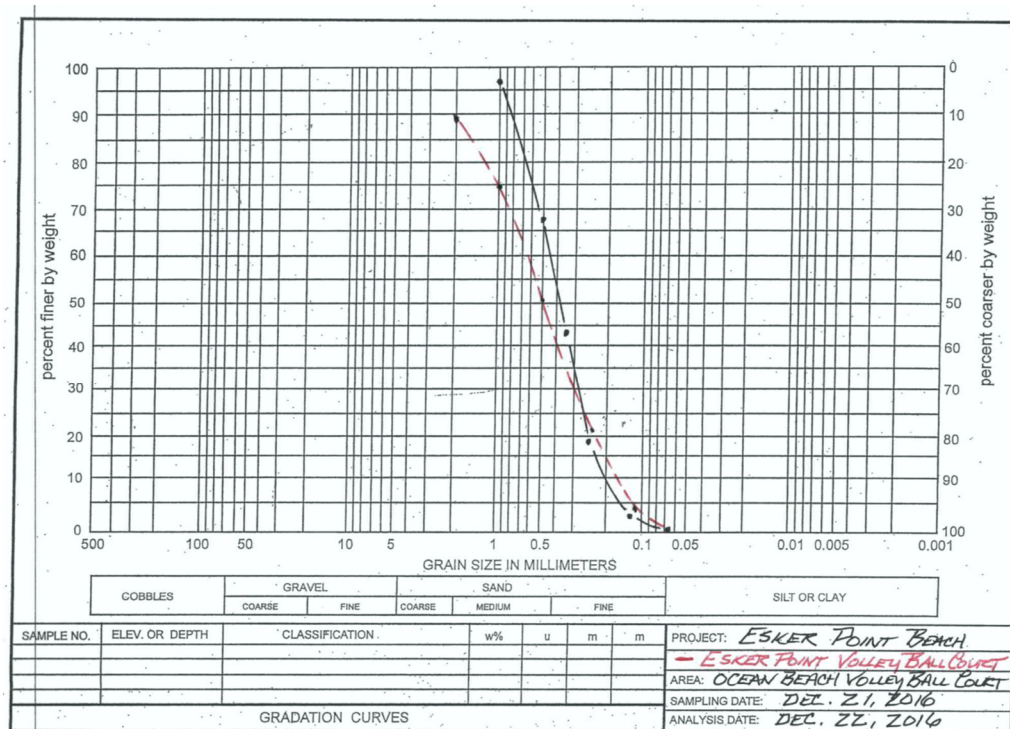


Figure 10 Sediment Grain Size Comparison- Esker Point and New London